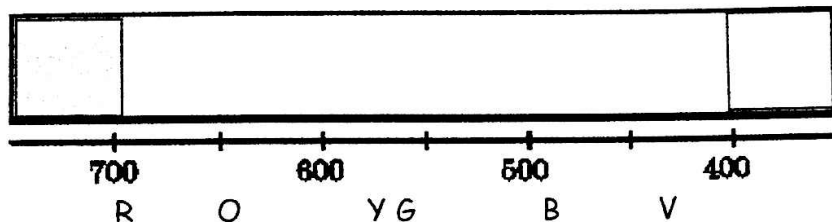


# Introduction ← WEDNESDAY INTRODUCE

In this activity you will examine the spectra produced when viewing a variety of light sources through a diffraction grating. A diffraction grating can break up light into its component wavelengths, much the same as a prism can break up sunlight into the colors of the rainbow. In the rectangles below, use color pencils to sketch the spectrum you see from each source. The numbers below the rectangles represent the wavelength of the light in nanometers ( $\times 10^{-9}$  m)

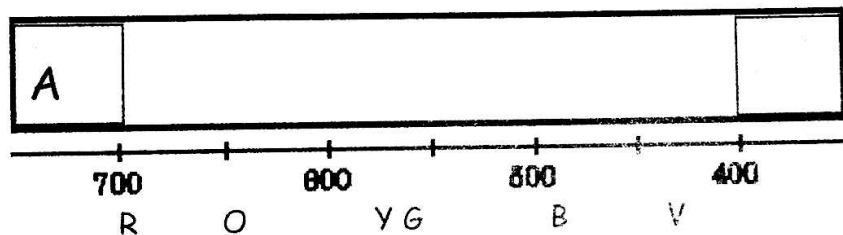
1. View an incandescent light bulb through a diffraction grating. Inside the bulb a tungsten filament is heated until it glows.



incandescent  
light bulb

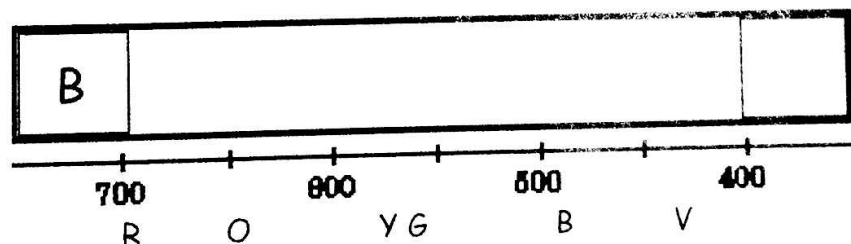
Color without prism-  
 \_\_\_\_\_

2. Now view the spectra of two gas discharge tubes. In these tubes, atoms in a low-pressure gas are excited by being bombarded by a stream of high-energy electrons. Record which gas is in the discharge tube you observe.



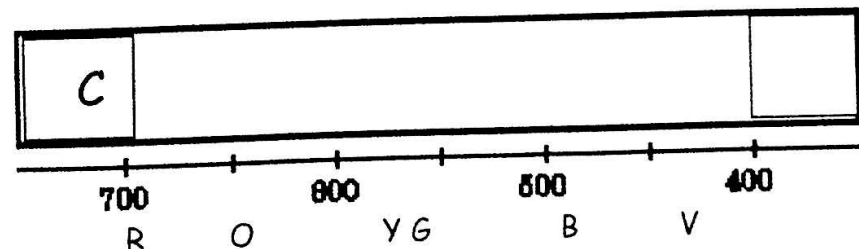
gas discharge tube

Color without prism-  
 \_\_\_\_\_



gas discharge tube

Color without prism-  
 \_\_\_\_\_



gas discharge tube

Color without prism-  
 \_\_\_\_\_

## Questions

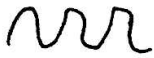
1. At which end of the spectrum (blue or red), does light transfer more energy? Explain how you know in terms of the relationships we have discussed this far.

BLUE - ↑ FREQUENCY; ↑ ENERGY

2. a. What happens to the wavelength of light as you go from blue to red? Explain.

THE WAVELENGTH INCREASES

- b. Use a drawing to represent both blue and red wavelengths.



BLUE



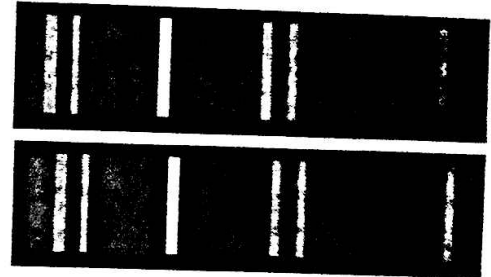
RED

3. The top diagram on the right shows the normal colors of light (of the visible spectrum) given off by a stationary star as seen from a stationary observer.

The bottom diagram shows the same star, but now the star and/or observer are moving relative to one another. Notice how the colored spectral lines are not in the same position but are the same distance apart from one another. The entire spectrum has been shifted in the bottom diagram.

Red color

Violet color



- a. How has the color the star shifted (i.e., red or blue shifted) in the bottom diagram?

BLUE SHIFT

- b. How are the star and observer moving relative to one another to produce this shift?

THEY ARE MOVING CLOSER TOGETHER

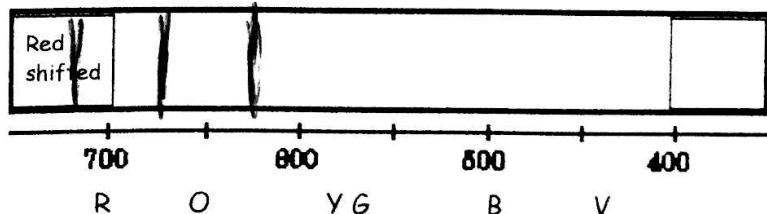
4. Most all galaxies in the universe have been found to have a deep red shift in the light that reaches the earth. What does that tell us about the direction that these galaxies are moving?

GALAXIES ARE MOVING AWAY

5. How do these observations provide evidence for the Big Bang?

THE BIG BANG SAYS THAT ALL MATTER WAS ONCE IN A HOT DENSE SINGULARITY - THEN IT EXPLODED AND EVERYTHING HAS BEEN MOVING OUTWARD

6. Using spectral fingerprint \_\_\_\_\_, from the front. Show the diagram red and blue shifted below. AWAY SINCE

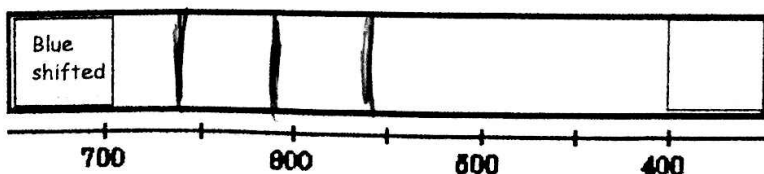


gas discharge tube

NEON

Color without prism-

RED/ORANGE



gas discharge tube

NEON

Color without prism-

RED/ORANGE